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auf Grund der Meridiankreisbeobachtungen der von Kuffner'schen Sternwarte, presented by the authors; Pulkowa Observatory, Ascensions droites moyennes des étoiles principales, par A. Sokolov, presented by the Observatory; H. Struve, Beobachtungen der Saturnstrabanten, presented by the Pulkowa Observatory; Venus Durchgänge, 1874, 1882, Bericht über die deutschen Beobachtungen, Band I., herausg. von A. Auwers, presented by the German Transit of Venus Commission; L. Weinek, Photographischer Mond-Atlas, Heft 4, presented by Professor Weinek.

Observations of Hind's Variable Nebula in Taurus (N.G.C. 1555), made with the 40 inch Refractor of the Yerkes Observatory. By E. E. Barnard.

In *Monthly Notices, R.A.S.* for 1895 June, I have given a historical account of the celebrated variable nebula of Hind (N.G.C. 1555).

This object was discovered by Mr. J. R. Hind 1852 October 11, at Mr. Bishop's Observatory, London, and his original account of the discovery will be found in *A.N.*, No. 839.

When discovered by Hind, and for some years subsequently, this nebula was a conspicuous object in an ordinary telescope, It was seen and measured by D'Arrest, Struve, and Lassell, and was close south, preceding a small star since known as the variable *T Tauri*.

About 1860 the nebula had disappeared in ordinary telescopes, and by 1868 it seems essentially to have also vanished from the largest instruments.

In 1868 Struve found another small nebula 4′ preceding the place of Hind's. This object was afterwards observed by D'Arrest and Tempel. The latter saw this nebula 1877 November 8. It was $1\frac{1}{2}'$ in diameter, with a small star in the northern portion of it. On December 12 of the same year it had disappeared from Tempel's telescope, but two small stars were visible at its place, the northern of which was the one seen on November 8 in the nebula 40″ south, following the centre.

These objects seem to have been neglected after this until the fall of 1890, when Mr. Burnham took up the subject with the 36-inch (*Monthly Notices*, 1890 December, also *Pub. L.O.*, vol. ii., p. 175). I was kindly invited by him to share in the observations.

From the fact that he found *T Tauri* to be the nucleus of a small extended nebula, and that, by a singular coincidence, that star's position in the D.M. was erroneous by a quantity that made it exactly coincide with the position of Hind's nebula, Mr. Burnham concluded the star with its nebulosity was the variable nebula

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itself. While observing with him, I detected a very faint round nebula, close south preceding the star, and entirely disconnected from it. This nebula was supposed by us to be new and unknown, as it was unlikely that any other telescope could have shown it.

Remembering this nebula a few years later, it occurred to me to look it up and determine its position. It was therefore sought for on 1895 February 25, and was easily found. It appeared somewhat brighter than in 1890, and was an easy object. (It was actually seen on February 26 with the 12-inch.) I measured its position with reference to *T Tauri* and, upon looking up the place of that star, found to my surprise that the position in the *D.M.* was in error. With the true place of *T Tauri* my nebula came out identical in position with Hind's variable nebula of 1852 ! To my further surprise I found that the very definite and brightish nebula, which Mr. Burnham had found *T Tauri* the nucleus of, and which I had seen with him, had entirely disappeared ! There seemed to be, however, some feeble traces of nebulosity surrounding the star, but the distinct nebula of 1890 was gone.

At no time could either Mr. Burnham or I see any traces of Struve's nebula, 4′ preceding these objects, though we looked carefully for it. In my observations of 1895, however, I measured a small star that essentially occupied the place of Struve's nebula, and which was undoubtedly the brighter of the two mentioned by Tempel in 1877, and which D'Arrest had spoken of previously as being the eccentric 14-mag. nucleus of Struve's nebula ; but I did not see any second star.

This region was again examined with the 36-inch in the following September, on the 15th, 22nd, and 23rd, under the very finest conditions. No trace of Hind's nebula could be seen. It had absolutely disappeared in the great telescope. Every effort was made to see it, by occulting *T Tauri*, by the use of different magnifying powers, &c. (*Monthly Notices* for 1895 December). *T Tauri* itself seemed unchanged from its appearance in the previous February and March. Nothing was visible of Struve's nebula. A second and much fainter star, however, was seen south of the small one previously measured at this point, and this must have been the second of Tempel's stars. It was at the limit of the 36-inch under the finest conditions, and was estimated at 17th magnitude. This small star must therefore have faded greatly since Tempel's observations of 1877, for it would have been impossible for him to see it with 11 inches aperture.

I have thus briefly sketched the history of this singular region as a prelude to my observations of it here with the 40-inch. I would, however, refer those interested in the matter to the more detailed papers in *Monthly Notices* for 1895 June and December.

One of the first things examined here with the 40-inch was *T Tauri* and the region of Hind's and Struve's nebulæ. These observations were begun 1897 September 20. The seeing on

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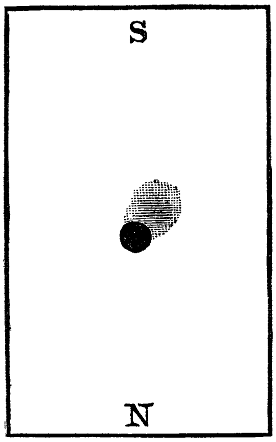
this date was fair, but there was no trace of either of these nebulæ, and *T Tauri* appeared unchanged. The brighter of the two small stars was seen at the place of Struve's nebula.



T Tauri, 1897 September 22, &c.

On September 22 no trace of either nebula was seen, though the conditions were fair. But, upon close examination, *T Tauri* was seen to have a very small and very close nebulous patch attached to it on the following side. This was seen with various magnifying powers. At first the star appeared to be double, but the higher powers showed the appearance to be due to a very small nebula or nebulous patch very close south following the star, perhaps from 1″ to 2″ distant.

September 26, Mr. Burnham and I examined *T Tauri* and the region of Hind's and Struve's nebulæ. No trace of these objects was seen. *T Tauri* appeared as in the observations of 1895. Nothing whatever was seen of the small brightish nebula in which it shone in 1890. The seeing was not quite good enough to see the small nebulous patch of September 22.

September 28, with good seeing, Hind's nebula could be very faintly seen, but with the utmost difficulty, occupying the position of 1890 and 1895. It was excessively faint and difficult, but seen with certainty; it was at the limit of vision, and could not have been brighter than the 17 magnitude. The small nebulous patch close s.f. *T Tauri* was seen. No trace of any nebulosity existed at the place of Struve's nebula. The small star at that point seemed considerably brighter than formerly. The small star south of this was visible, but it was excessively faint and at the limit of vision. Its position was measured with reference to the brighter of the two.

Position angle, 193°·2 (3); distance, 18″·25 (3). The measures were made with the utmost difficulty.

October 26. Sky too thick, but the brighter of the two small stars was visible.

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November 2. Sky white from moonlight. Could see the fainter of the two small stars (as also the brighter one), but with the utmost difficulty. Sometimes this very faint star appeared like a very faint, very small nebula 1″ or 2″ in diameter. This, however, was uncertain. It also appeared nebulous to me with the 36-inch in September 1895. But an observation of this kind, at the limit of vision, cannot be depended on.

November 23. Sky thick, and the seeing too bad to make out anything.

1897 December 25. Examined very carefully ; nothing seen of the Hind or Struve nebula. The two small stars were visible however—the faint one for only a moment.

1898 September 26. Perhaps faint traces of Hind's nebula could be made out, but not with any certainty. The two small stars at the place of Struve's nebula were visible—the northern one quite bright, the other excessively faint.

October 10. No trace of Hind's nebula with any certainty. The northern of the two small stars pretty bright—11^{m} or $11\frac{1}{2}^{\text{m}}$. Seeing fearfully bad ; the stars boiling.

December 10, $7^{\text{h}}\ 40^{\text{m}}$. Only the vaguest glimpses of Hind's nebula made out, but it was certainly seen by hiding *T Tauri.* Conditions were fairly favourable. The two small stars were visible, but nothing of Struve's nebula. The south star was excessively faint, but was fairly well seen. Observed again at $11^{\text{h}}\ 30^{\text{m}}$, but seeing too poor to do anything.

I have never seen anything of the two small stars shown in Tempel's sketch in *Ast. Nach.* 2212 close north preceding *T Tauri.*

In conclusion, we have evidence that Hind's nebula still exists, but in a most excessively faint condition in the most powerful telescope under the very best conditions.

It is possible that these glimpses of the nebula seen here are due to slight fluctuations in its light. The observations of 1895 show that from an easily visible object in February and March of that year it had utterly disappeared in the same telescope (36-inch) six or seven months later. It was brighter in 1895 than in 1890.

Whether its visibility in 1890 was due to an increase of its light after it was lost sight of many years before, or was simply due to the more powerful telescope, we have no means of telling. But it had certainly brightened up in the spring of 1895, and as certainly faded very greatly soon after that.

Whether the light of this nebula is approaching absolute extinction, or is simply subject to great fluctuations, will be an interesting question for the future to decide.

From the early accounts of the nebula, one is impressed with the idea that it had not long been of its brightness when Hind found it in 1852. If so, we should probably again see it with small telescopes. It is, therefore, worthy of a close watch. At present this must be done with powerful telescopes, for it is of that class of nebulæ which are best seen in a large telescope.

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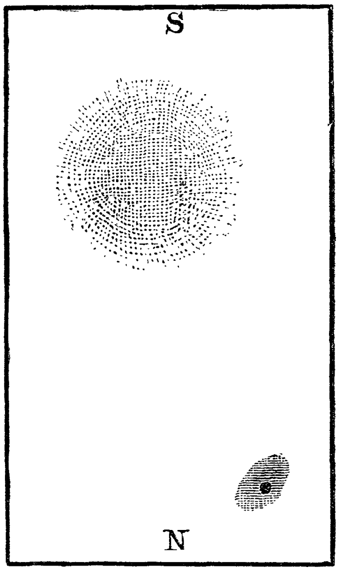
From the glimpses I have had of it lately, its faintness does not seem to be due to diffusion of its light over a larger area; it seems to be of the same size as formerly, and to have simply diminished in visibility through an actual loss of light.

I have lately found a note and sketch concerning the appearance of *T Tauri* and Hind's nebula at the observations of 1890 which should have been incorporated in my paper in the June 1895 *Monthly Notices.* As a matter of record it is well to introduce these in the present paper.



Sketch of *T Tauri* and Hind's Nebula 1890 Oct. 15.

"1890 October 15 at $13\frac{1}{2}^{h}$. Mr. Burnham and I looked at the place of Hind's variable nebula in *Taurus* with the 36-inch. There is an elongated pretty bright stellar nebula, very small, which Mr. Burnham saw the other night and measured [this was *T Tauri*]. I saw an extremely faint round diffused nebula $\frac{3}{4}'$ diameter almost due south of it [*T Tauri*], estimated position angle 185°, distance $\frac{3}{4}'$. It was feebly brighter in the middle. We saw nothing at the place of Struve's object 4′ preceding what we have assumed to be Hind's nebula [*T Tauri*]."

Yerkes Observatory, Williams' Bay, Wisconsin:
1899 *January* 27.

Periodic Variation in the Colours of the two Equatorial Belts of Jupiter. By A. Stanley Williams.

The very beautiful and often very pronounced colours of the belts of *Jupiter* have long attracted the attention of observers. When observing the planet in the year 1879 with a $2\frac{3}{4}$-inch refractor I was much struck by the colours of the two equatorial